1.1 Basic Models
1.2 Direction Fields
2.3 Modelling with ODEs
2.1 Separable ODEs
2.2 Linear First-Order ODEs
2.4 Linear vs Nonlinear ODEs
2.5 Autonomous ODEs

2.1 Separable ODEs

1. Which of these ODEs are Separable ODEs? Why?

   a. $\theta'' = -\frac{g}{L}\sin\theta$

   b. $v' = -g$

   c. $v' = -g - \frac{\gamma}{m}v$

   d. $y' = -gt - \frac{\gamma}{m}y + 10$

2.1 Separable ODEs

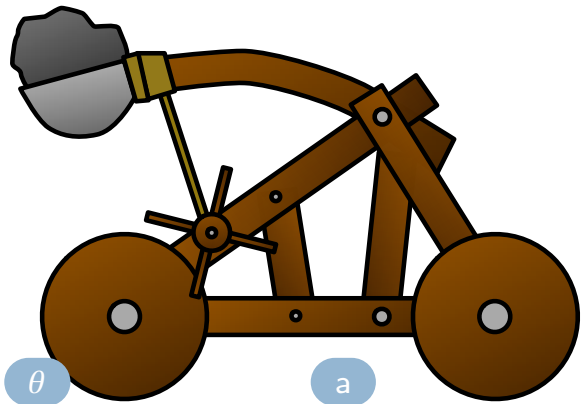
Let us recall the model for the altitude of a boulder thrown by a catapult:

$$v'(t) = -g - \frac{\gamma}{m} v(t)$$

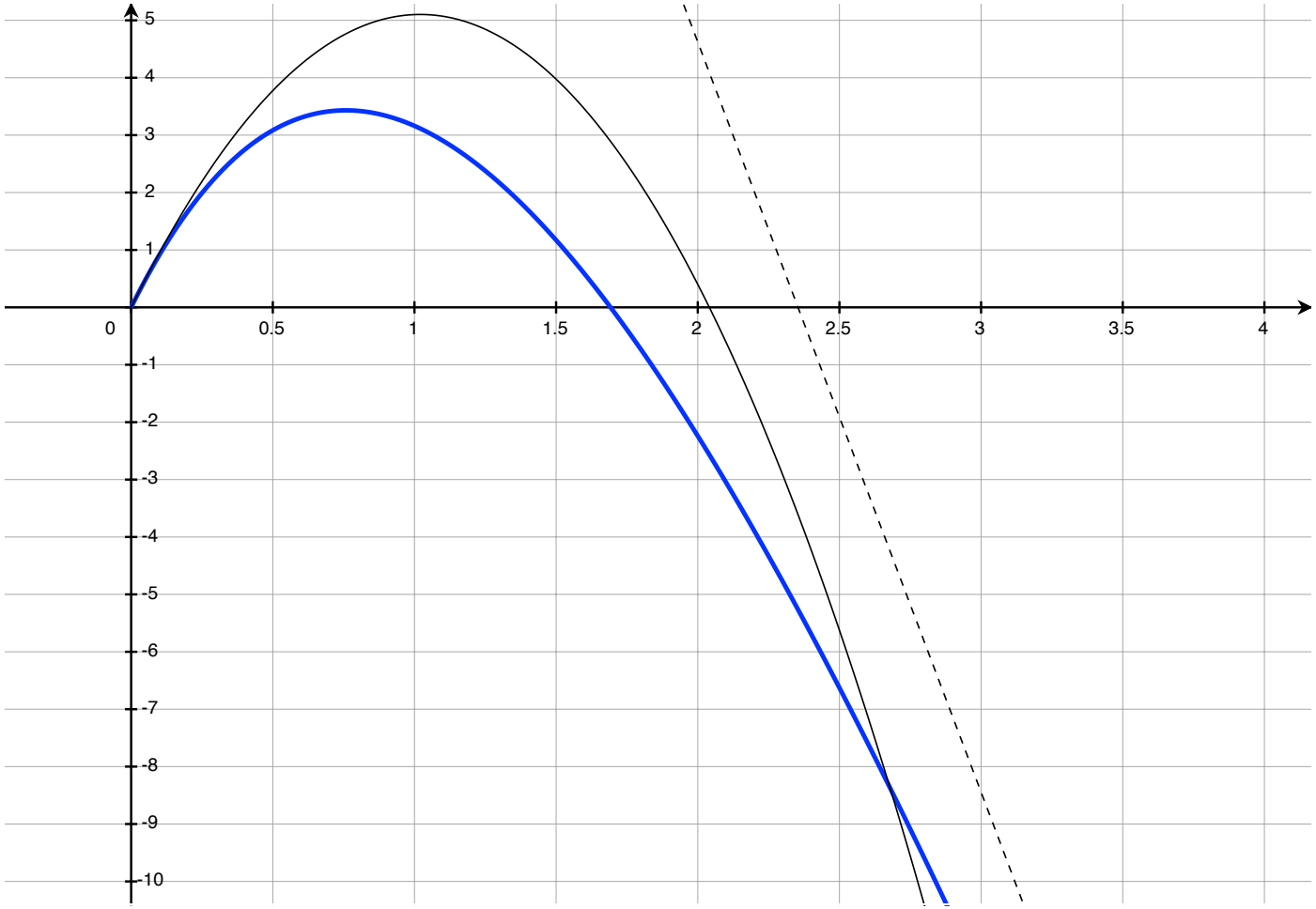
Initially the boulder has velocity v_0.

2. What is $v(t)$?

3. What is $y(t)$?



2.1 Separable ODEs

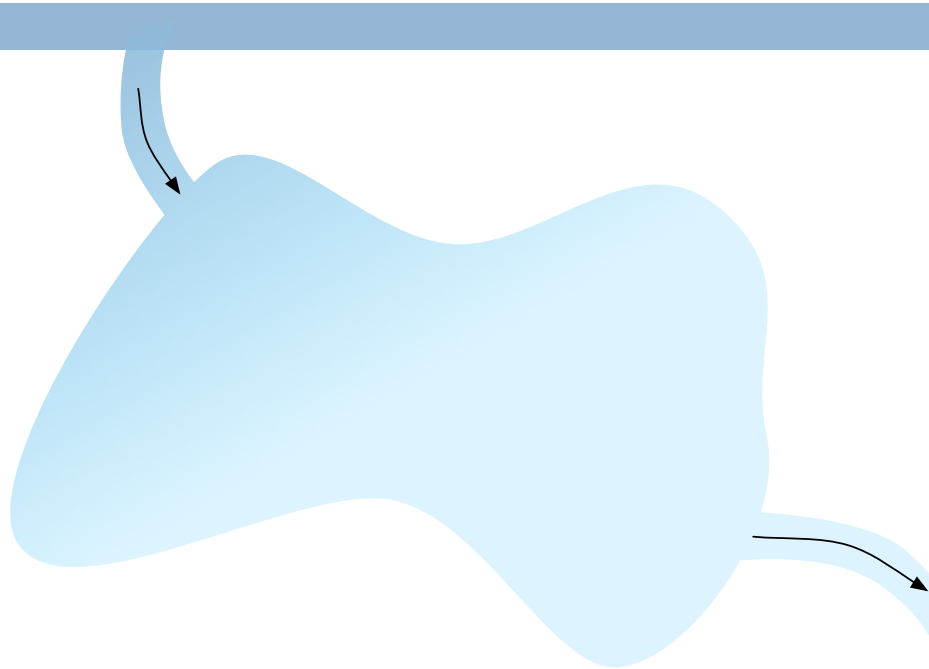


4 What does the dotted line represent?

Modelling pollution in a lake

- Lake contains V L of fresh water
- Water flows into and out of the pond at the rate of r L/year
- Incoming water is polluted with

$$\gamma(t) = 2 + \sin(2t) \quad \text{kg/L of pollutant}$$



5. Obtain an ODE for the amount of pollutant (in kg) at time t. (check units)

6. Which assumptions are made in this model?

Preparation for next lecture

2.2 First Order Linear ODEs

- Watch https://youtu.be/ezhi3E_bdvk

- Identify a First-Order Linear ODE
- Know how to solve a First-Order Linear ODE